GENETICALLY MODIFIED FOODS & CROPS

some facts that everyone should know



Centre for Sustainable Agriculture, 2013

Why are field trials and commercial release of GM foods and crops an issue?

"Considering the flaws and the shortcomings noticed by the Committee in the functioning of the regulatory mechanism meant for the purpose, the lack of preparedness of various agencies who should ideally be involved in various oversight and both pre and post commercialization surveillance responsibilities in the context of transgenic crops, the still unclear ramifications of transgenic crops on bio-diversity, environment, human and livestock health and sustainability, the Committee desire, in consonance with their recommendation in a previous Chapter, that for the time being all research and development activities on transgenic crops should be carried out only in containment, the ongoing field trials in all States should be discontinued forthwith".[1]

-The Report of the Parliamentary Standing Committee on Agriculture "Cultivation of Genetically Modified Food Crops, Prospects and Effects", August 2012. The members of the Standing Committee on Agriculture, across political parties, were unanimous in their report.

The Technical Expert Committee appointed by the Supreme Court, in its interim report of 17 October, 2012, had also recommended a 10-year moratorium on field trials of Bt food crops, a moratorium on field trials of Herbicide Tolerant crops (till independent assessment of impact and suitability) and ban on field trials of GM crops for which India is the centre of origin and/or diversity.[2]

Why did they make these recommendations? Field trials are conducted before establishing biosafety. GM contamination from field trials may be detected after years, and is irreversible. India is the centre of origin and diversity for most of the proposed GM crops. Extreme caution has rightly been recommended to avoid serious ecological, economic, health and seed sovereignty concerns.

What is GM in agriculture?

Genetic Modification or GM is also called Genetic Engineering (GE), transgenic technology, or recombinant DNA technology. It involves genetically modified organisms (GMOs) or living modified organisms (LMOs) such as plants, animals, insects etc. It is one of many forms of biotechnology.

GM is the most controversial agricultural technology in the world. The World Health Organization defines GMOs as "Organisms in which the genetic material (DNA) has been altered in a way that does not occur naturally".[3] This is usually done by inserting genes of related or unrelated species into an organism's DNA in an attempt to transfer, or stop expression of, a specific trait. (For instance a gene from a bacterium has been inserted in a plant and even a fish gene was once inserted into a tomato variety). GM technology is presently crude, imprecise and unpredictable.

Currently 99% of GM crops have only two GM traits - *pesticide production* within the plant e.g. plants engineered with the gene from the soil bacterium *Bacillus thuringiensis* (Bt) and *herbicide tolerance (HT)* enabling the engineered plant to withstand high doses of a particular herbicide spray. Usually the herbicide is patented by the same company which produces the HT GM seed.[4]

Companies promoting GM technologies claim benefits like higher yields, lower pesticide use and other beneficial traits. However, many governments, independent scientists, consumer groups, farmers' unions and citizens, say that these benefits are more hype than truth and that the risks far outweigh benefits, if any.

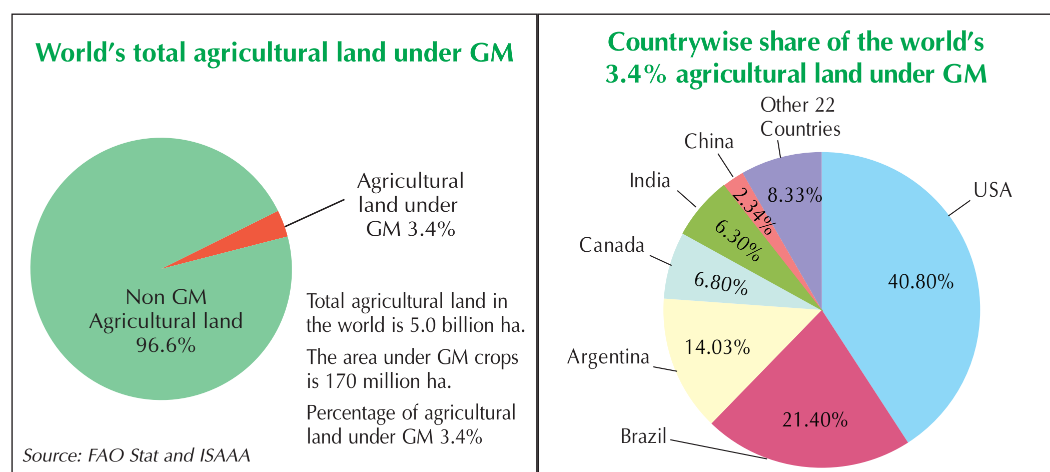
"It would be too generous even to call GM crops a solution in search of a problem: these crops have failed to provide significant solutions, and their use is creating problems - agronomic, environmental, economic, social, and (potentially) human health problems."

- National Farmers' Union of Canada

Will Indian agriculture be left behind if it does not adopt GM crops?

Seventeen years after its introduction, only 3.4% of the world's agricultural land is sown with GM seed and 62% of this is in the United States and Brazil. Only four crops - soy, corn, cotton and canola - account for 99% of GM crops worldwide. Yet, in India, 17 GM crops are presently awaiting approval and many more are in the pipeline. Is this either necessary or beneficial?

Only five countries, including India, account for almost 90% of the 3.4% total agricultural land under GM.[5] As GM faces increasing resistance from consumers and farmers throughout the world, most other countries have either rejected or strictly regulated GM crops. China recently placed restrictions on GM rice in response to public concern about its health impacts. It has also sacked officials for undertaking unapproved experimentation with GM rice and has proposed a grain law, to impose restrictions on GM research, field trials and commercialization of major grains.[6]



Globally the percentage of agricultural land under GM increased by less than 0.5% between 2011 and 2012. India's huge seed market is extremely attractive to GM seed companies, especially since their expansion faces opposition in other countries. GM seed companies and their sponsored lobbying groups, assert that GM represents the most recent innovations and cutting edge technology in agriculture which India cannot afford to forego. In fact, the proposition that scientific advances in agriculture are best done by large corporations is questionable.

A recent peer-reviewed report called "Late Lessons from Early Warnings" released by the European Environmental Agency points out that top down technologies like GM crops fail to address food security issues whereas bottom-up agro-ecological approaches can do so. It also finds, as do other reports, that technology based on corporate investments leading to patent based intellectual property rights (IPR) often closes down, rather than develops, the innovation potential of farmers.[7]

To reap the benefits of the huge amounts spent on developing GM seeds, companies try to recover their investments by 'market capture' i.e. promoting a narrow range of crops and varieties (hybrids) and eliminating competing or traditional seed varieties. In contrast, many farmers practicing ecological farming are more efficient because of their deep understanding of ecological processes, which modern agriculture neglects. They can obtain sustainably high yields and devise valuable agricultural innovations, which they share with others. In India, it is small farmers who have obtained record yields for several crops, through sustainable agro-ecological and non-GM methods.[8]

Sumant Kumar, an innovative farmer of Darveshpura in Bihar created a new world record by producing 22.4 tonnes of rice, using SRI (system of rice intensification), on one hectare of land. This record breaking yield was obtained using non-GM seeds.



Photo: Chiara Goia, The Guardian

Another promised benefit of GM crops, insect resistance, attracts farmers greatly as it immediately reduces pesticide use, but this gain is short lived. Over time, the target pest develops resistance and secondary pests often increase. An example is that of Bt cotton, where the pink bollworm developed resistance in less than a decade and where sucking pests have increased dramatically. At the time of release it was mandated that a certain refuge area around a GM crop should be maintained to delay resistance. This has been blatantly violated in the case of Bt cotton in India and it has been impossible for the government to take any measures to correct this. Studies from USA[9] and China[10] also show that resistance has developed in targeted insects, inspite of refuge areas being maintained.

Many other risks exist according to numerous studies.[11] GM contamination is a very serious risk for farmers and the nation. According to a survey by ASSOCHAM, the demand for organic food in India is estimated to be growing annually at 40%.[12] Moreover, India is also ideally placed to meet the growing global demand for organic produce. Already India is the largest producer of organic cotton. GM contamination is unacceptable to many countries. The discovery in May 2013 of GM wheat growing in US farms, years after field trials ended, has deeply worried wheat farmers. They recall the huge losses to US rice farmers and exporters when GM contamination of US long grain rice was detected in Europe in 2006. Protracted litigation forced Bayer CropScience to pay $ 750 million compensation. Bt contamination of Indian organic cotton has been detected in Europe.[13] Indian farmers do not have the financial capacity to litigate against large corporations.

What liabilities will be fixed for unwanted contamination by GMOs of any farmer's crop? How will penalties be enforced and on whom? Till safety from contamination can be effectively ensured, use of GM seeds is clearly a violation of the 'Right of Choice' of farmers and consumers who wish to remain GM free.

> *"The promise was that you could use less chemicals and produce a greater yield. But let me tell you none of this is true."*
>
> *— Bill Christison President of the US National Family Farm Coalition*

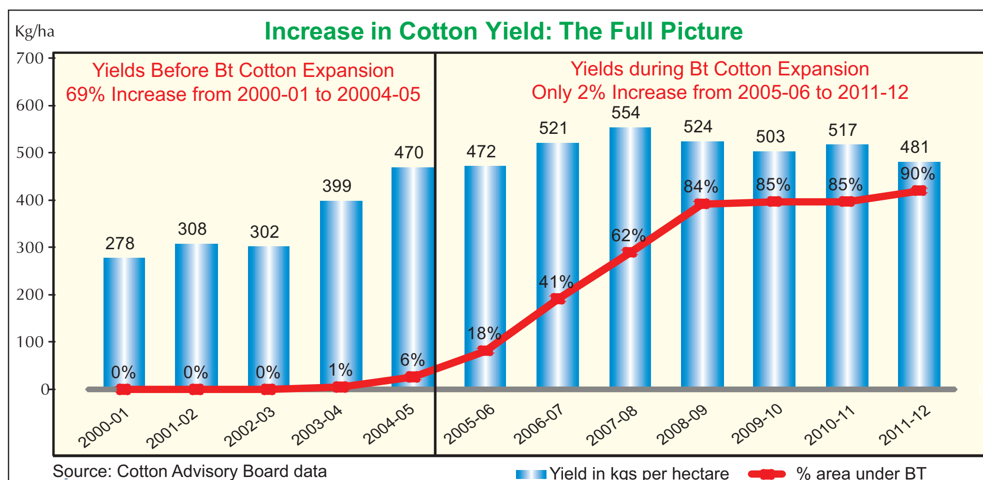
Do GM crops increase yield?

Yield depends on many factors – seed, soil, water, climate, pests, crop management practices are a few. There is no single gene that can be transferred to seeds which magically increases yield. The Union of Concerned Scientists, USA, in its report "Failure to Yield" studied 13 years of crop yields in the U.S. after the introduction of GM crops. It found that there have been no overall increases in yield, operational or intrinsic, in either HT corn or soybeans. Only in Bt corn was there a small operational yield increase of 3 to 4%.[14] Conventionally bred seeds can deliver higher yields in shorter periods and with less investment, as many field studies show.[15] Some agricultural scientists describe GM technology, with its discredited claims to yield increases, as a costly distraction for a country. It diverts government attention and funds from better options.

> *"Despite 20 years of research and 13 years of commercialization, genetic engineering has failed to significantly increase U.S. crop yields".*
>
> *– Doug Gurian-Sherman "Failure to Yield", Union of Concerned Scientists, 2009*

Has cotton yield increased in India due to Bt cotton?

Cotton production in India has increased primarily because area under cotton has increased and not because yield per unit of land has increased significantly due to Bt cotton. Data from the Cotton Advisory Board shows that from 2000-01 to 2004-05, when the area under Bt cotton increased from 0% to only 6% of the total area under cotton, there was a 69% increase in yield. Thereafter, as area under Bt cotton expanded from 6% to 90% by 2011-12, yields initially increased by just 18% up to 2007-08 and then declined to a level which was a mere 2% over the 2004-05 pre-Bt gains. K R Kranthi, Director of the Central Institute for Cotton Research (CICR), notes that "The yield increase by 2004 was mainly due to the integrated pest management/integrated resistance management strategies, new insecticides, new hybrids and new areas in Gujarat, apart from the 5.4 per cent area under Bt cotton". [16] In Gujarat, minor irrigation was increased through 1,00,000 new check dams in Saurashtra during this period.



> *"The main issue that worries stakeholders is the stagnation of productivity at an average of 500 kg lint per hectare for the past seven years."*
>
> *– K R Kranthi*
> *"Bt Cotton Q & A" 2012*

Have GM crops increased global food security?

Currently the main argument being put forward is that GM crops are essential for ensuring food security, i.e. to feed a growing global population that may touch 9 billion by 2050. This type of scaremongering in the past has been belied by increases in agricultural output, which occurred without GM seeds. The world already produces enough food for 13 billion people, so the problem is not of food production but of access to it by the poor.[17]

The world's largest GM crop adopters are USA, Brazil and Argentina. They account for 76% of all land under GM. In the US, the percentage of food insecure has risen from 12% in 1995 to 15% of the population in 2011. In Brazil, the rate at which hunger is reducing has decreased. In Argentina hunger has not decreased after the introduction of GM crops. In Paraguay, where nearly 65% of the land is under GM, hunger has increased from 12.6% in 2004-06 to 25.5% in 2010-12.[18] These figures show that GM crops have not increased food security in these countries.

> *"We strongly object that the image of the poor and hungry from our countries is being used by giant multinational corporations to push a technology that is neither safe, environmentally friendly nor economically beneficial to us…. we think it will destroy the diversity, the local knowledge and the sustainable agricultural systems that our farmers have developed for millennia and that it will thus undermine our capacity to feed ourselves."*
>
> *–Statement to the FAO signed by 24 delegates from 18 African countries*

Does India need GM crops to produce more food? What is the real cause of hunger?

India had 667 lakh tons of grain, two and a half times the required buffer stock, as of January 1, 2013 and had huge surpluses every month before that.[19] Despite the fact that 25% of India's population – more than 200 million people – are hungry, this grain either rotted in the granaries or was exported. Despite bumper crops of wheat and rice, India continues to have one third of the world's hungry.[20] Clearly, the crisis is not of food production but of the financial inability of the poor to buy or grow food. Added to this is the prevailing inefficiency and corruption in food storage and distribution. These issues cannot be addressed by the purported 'techno fix' of GM crops.

> *"Spurred by agricultural innovation and generous farm subsidies, India now grows so much food that it has a bigger grain stockpile than any country except China, and it exports some of it to countries like Saudi Arabia and Australia. Yet one-fifth of its people are malnourished – double the rate of other developing countries like Vietnam and China – because of pervasive corruption, mismanagement and waste in the programs that are supposed to distribute food to the poor."*
>
> *– Vikas Bajaj*
> *"As Grain Piles Up, India's Poor Still Go Hungry" New York Times, June 7, 2012*

Are bio-fortified GM crops required in order to combat malnutrition?

Bio-fortified crops are artificially enhanced with nutrients – a technological solution to a political and socio-economic problem. GM rice and bio-fortified bananas are among the GM crops now being touted as solutions for malnutrition: the former supposedly to provide beta-carotene and the latter to provide iron. However, these merely divert efforts from working towards real solutions.



Photo: Dilnavaz Variava

Organic kitchen gardens cost little and have huge nutritional benefits for entire families. In contrast, GM biofortification of foods is neither necessary nor cost effective.

According to the World Health Organisation's malnutrition expert, Francesco Branca, Vitamin A supplements backed up with education programmes, eating certain types of vegetables etc. are more promising approaches to effectively combat Vitamin A deficiency.[21] GM rice, disingenuously named 'Golden Rice', is said to enhance beta-carotene. To actually fight Vitamin A deficiency, it would need to be eaten in huge quantities and would also require an assured minimum supply of fat in a person's diet, which the poor cannot afford.[22]

Increased access to an appropriate and varied diet is the best way to combat malnutrition. India has thousands of traditional crop varieties rich in nutritional and medicinal properties. The resources being poured into the development of risky GM foods, often using public funds, are better diverted to promote the growing of millets, organic kitchen gardens and other programmes which can effectively combat anaemia and Vitamin A deficiency.

"Genetic engineering might be worth the extra cost if classical breeding were unable to impart such desirable traits as drought, flood and pest resistance and fertilizer efficiency. But in case after case, classical breeding is delivering the goods."

–Margaret Mellon and Doug Gurian-Sherman, Union of Concerned Scientists, USA, 2011

What are the economic implications of introducing GM crops in India?

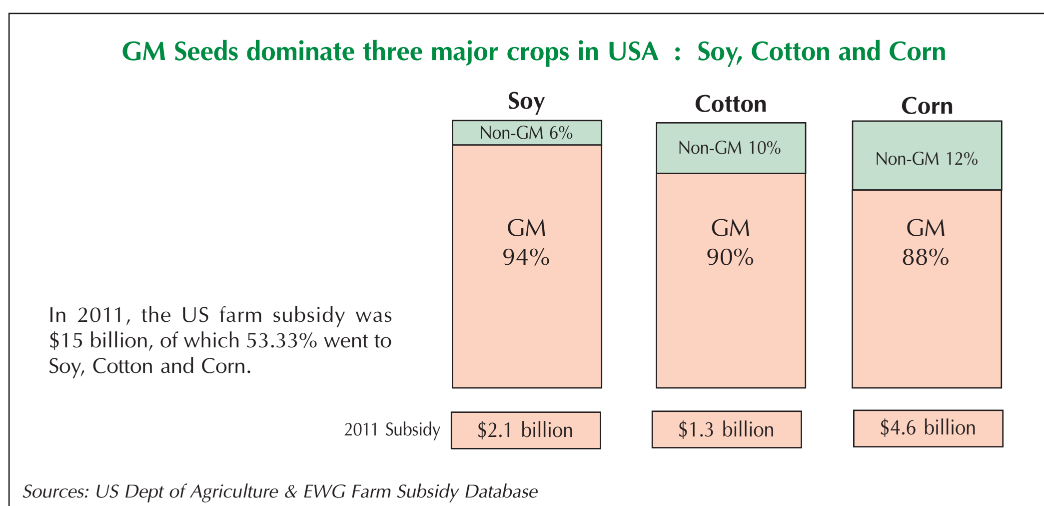
In many countries, the introduction of patented GM seeds has resulted in a seed monopoly, thereby drastically reducing farmers' seed options. In the United States, after the introduction of GM seeds, available corn varieties have decreased by 67% i.e. from 3,226 varieties in 2005 to 1,062 in 2010.[23] GM soy has captured 90% of the US market and soy prices have risen by 325% between 1995 and 2011.[30]

GM technology is based on patents which are often ruthlessly exercised to force farmers to buy these high cost seeds every year. Since litigation would be impractical against millions of small farmers in India, a new business tactic was used by the GM seed companies. The Bt gene was introduced in cotton hybrids which compel farmers to buy fresh seeds every year, rather than in re-plantable varieties, as is done in all other countries in the world. Non Bt cotton seed has virtually disappeared from the marketplace. India's rich heritage of thousands of cotton varieties, for which it was once famous, is now limited to seed banks, out of reach of ordinary farmers.

Within 8 years, (upto 2009-10), Bt cotton alone is estimated to have resulted in total royalty payments and technology fees of Rs 1580 crores (Rs 15,800 million) to Monsanto and its Indian licensees.[24] Though some irrigated farmers may have benefited, indebtedness and suicides among the majority of rainfed cotton farmers have increased, not decreased, after introduction of Bt cotton.[25] A thorough, independent and transparent analysis of the reasons for Bt cotton's highly varying performance is essential before considering other GM crops.

Herbicide Tolerant (HT) cotton and corn are presently being pushed for release in India. HT seeds, such as Monsanto's Roundup Ready corn and cotton, are engineered to withstand spraying with its designated herbicide, glyphosate based Roundup, ensuring a double benefit to the agro input company. HT seeds may be economically useful in USA where the average farm size is over 400 acres[26] and labour for manual weeding is unviable. In India the average farm size is barely 2.5 acres[27] and the manual removal of weeds is a major source of employment for rural women.

The United States, the largest user of GM seeds, props up its agriculture with massive subsidies. Of the 15 billion dollar farm subsidies in 2011, 53.33% went to three major GM crops grown in the US namely soy, cotton and corn.[28] If GM is an economic success, why is its expansion into new crops not taking place rapidly in USA? If it is a failure, why are 17 GM crops being considered for introduction in India?[18]



Sources: US Dept of Agriculture & EWG Farm Subsidy Database

In India, Bt cotton farmers in rain fed areas were in financial distress after availing of loans to buy costly seeds, which also require expensive chemical fertilizers and timely irrigation. The negative economic costs of loans and loan waivers for GM crops were borne by farmers and Indian taxpayers and not by the seed companies who make the profits. It may be noted that many of the large seed companies are also large pesticide manufacturers. Are farmers being put on a technology treadmill for ensuring the profits of these companies?

> *"Farmers have little choice but to tolerate such price hikes because of consolidation within the seed industry.... the GM industry dictates which seed varieties are available."*
>
> *– Michael Antoniou, Claire Robinson and John Fagan*
> *GMO Myths and Truths, Earth Open Source, June 2012*

Will GM seeds impinge on India's seed sovereignty?

Presently ten large global seed companies control 73% of the world's commercial seed market.[29] Fortunately for India, traditional varieties are still used in many areas and for numerous crops. Farmers are free to save, exchange and replant these seeds. However efforts are being made by seed corporations to replace many of these open pollinated varieties, first with hybrids and eventually with patented GM seeds, when approved. International patents impinge on farmers' traditional rights and can expose them to financially crippling lawsuits.

By the start of 2013 Monsanto had filed 144 lawsuits against 466 farmers in USA. Recently Monsanto got a $84,456 settlement, upheld by the US Supreme Court, against a farmer who bought soya seeds left over at a grain elevator and planted these without paying Monsanto for their use. The General Counsel of Monsanto, David F. Snively, says on their website that this judgment " ... allows America to keep its competitive edge".[30] GM seed companies' global expansion plans are often supported by their national governments, charitable foundations and universities, supposedly to remove hunger in countries like India. Contrary to these avowed intentions, litigation has been initiated against state governments in India who have tried to reduce or regulate GM seed royalties in the interests of lowering costs for farmers and consumers.[31]



Photo: CSA

If you control seed you control food. If you control food, you can control a nation.

There is another serious risk to India's control over its seed wealth. Being a country rich in biodiversity and the centre of origin or diversity for many crops, India has a wealth of indigenous germplasm. Seed companies are working with Indian universities and agricultural research institutions which hold large repositories of this invaluable germplasm. Indigenous seeds, developed by generations of Indian farmers, can by mere insertion of a gene provide patents for private profiteering and control of the Indian seed market by multinational corporations, jeopardising India's seed sovereignty. Restrictive patents, aggressive marketing and huge litigation and lobbying budgets of large transnational seed and biotech corporations is a cause for serious concern.

"Patented GM seeds transfer control of food production from farmers to seed companies. Patents also transfer control of the food supply from the Global South to developed countries in the Global North."

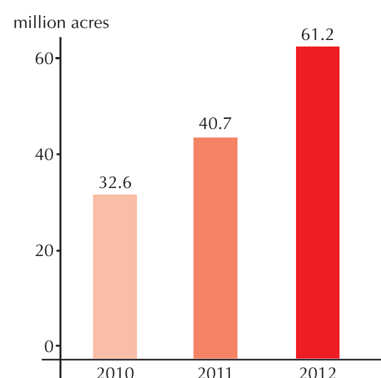
– Michael Antoniou, Claire Robinson and John Fagan
GMO Myths and Truths, Earth Open Source, June 2012

What are the environmental impacts of GM crops?

GM crops are falsely projected as being environmentally friendly. This is supposedly due to reduction in pesticide use, increased drought resistance capabilities and a requirment for reduced tilling. In fact GM herbicide-tolerant (HT) crops, which constitute more that 70% of all GM crops worldwide, have led to massive increases in herbicide use. There is not only more liberal spraying of herbicide, causing development of resistance in weeds, but the HT gene has inadvertently been transferred to weeds, creating 'super weeds'. About 61 million acres in the US are now plagued by herbicide resistant weeds, according to a report by Stratus Agri-Marketing of Canada.[32]



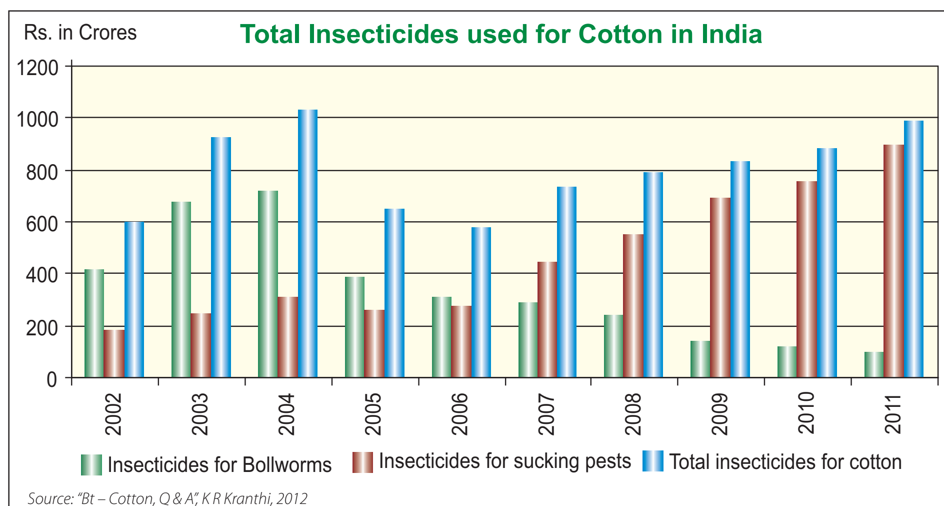
Superweeds, like this horseweed, have inadvertently acquired the HT gene from GM crops and have become a huge problem for farmers.



Areas with weeds resistant to glyphosate based herbicide, which is often used with GM seeds, are increasing rapidly. Presently 61 million acres in USA are infested.

Source: Stratus Agri-Marketing Report, 2013

A study by Charles Benbrook of Washington State University, USA, found that though insecticide use went down, herbicide use went up. He found that this resulted in an overall increase in pesticide use in USA of 404 million pounds from 1996 through 2011, due to GM crops.[33] Insecticide use in India after Bt cotton, has decreased for bollworms but increased for sucking pests.



Uptil now all technologies were controllable. Electricity, even nuclear power can be turned off. GM is the first irreversible technology in human history. When a GMO is released it is out of our control; we have no means to call it back."

— Susan Bardocz
Professor of Human Nutrition and Recipient Stuttgart Peace Prize 2009

What are the health concerns regarding GM crops?

Since 99% of GM crops are genetically engineeered to produce Bt toxin or to tolerate the spraying of herbicides, Indian citizens have reason to be seriously concerned about their impact on health. Bt (bacillus thuringiensis) toxin in its natural, non-GM form, when used as an insecticidal spray, behaves differently in the environment than Bt toxin produced in GM plants. Natural Bt toxin breaks down in daylight and only becomes active in the guts of insects. However, with GM Bt crops, the plant is engineered to express the Bt protein in every cell.[36] If any part of the plant is eaten, the toxin is inevitably consumed.

Bt cotton seed oil has become part of many edible oils sold in India, with most consumers completely unaware of this. Once GM foods are approved, it will be almost impossible to prevent their proliferation and unintended consumption.



Photo: Dilnavaz Variava

Most food in India is unpackaged and unlabelled. Once a GM food is approved and its seed released, a consumer's right to be protected from inadvertently consuming GM food will be lost.

GM crop promoters claim that millions of people in the US have eaten GM food for more than a decade, with no adverse effects. But the fact is that GM foods are not labelled in the US. Hence there is no way to track them and no conclusive epidemiological studies are therefore possible.

In 1996, GM soy and corn were introduced in USA. One of the earliest safety studies was in UK by GMO safety expert Arpad Pusztai, PhD. He found that lab animals fed GM feed developed lesions in the stomach, had damaged intestines, and abnormal and proliferative cell growth in the walls of the stomach and intestines. His adverse findings, and those of other researchers thereafter, have been denied and discredited. Biotech corporations, other researchers and food safety regulators say there are no adverse health effects. Despite this, many doctors and patients say that GM foods lead to increase in allergies, autism, infertility, birth defects,cancer and neurological problems.[37]

According to the American Academy of Environmental Medicine, "There is more than a casual association between GM foods and adverse health effects ... Multiple animal studies show significant immune dysregulation, including upregulation of cytokines (protein molecules involved in immune responses) associated with asthma, allergy, and inflammation." [38]

GM crops are usually approved on the basis of tests performed by the industry on rats and other animals over periods of upto 90 days. In rats, this corresponds to a human life span of about 12 years. This is much too short for long-term health effects such as organ damage or cancer to show up.

The first long term independent study "Long term toxicity of a Roundup herbicide and a Roundup-tolerant genetically modified maize" by the French molecular biologist GE Seralini of the Committee for Research and Independent Information on Genetic Engineering (CRIIGEN) came out in 2012.[39] This two-year study linked herbicide tolerant maize and the glyphosate-based herbicide Roundup to premature death and cancer in rats. Although this peer reviewed study has been criticised by a number of regulators and scientists (many with industry links), this study has also received statements of support and positive comments from more than 300 scientists from 33 countries.[40] This, and several other studies, point to the need for further detailed, independent and long term investigations.



Photo: CRIIGEN

The CRIIGEN long-term study linking HT GM maize & the herbicide Roundup to tumours and premature death in rats created controversy. Its outcomes underline the need for more independent studies and open debate on the long term effects of GM crops on health.

> *"Most studies with GM foods indicate that they may cause hepatic, pancreatic, renal, and reproductive effects and may alter haematological (blood), biochemical, and immunologic parameters, the significance of which remains to be solved with chronic toxicity studies."*
>
> *– A Dona & IS Arvanitoyannis, "Health risks of genetically modified foods" Critical Reviews in Food Science and Nutrition, 2009*

Is opposition to GM crops unscientific?

Opposition to GM crops is often dismissed as 'unscientific' and 'against farmer interests'. Despite alleged use of patent protection tools to prevent researchers from using GM seeds for independent scientific research, there is mounting independent scientific evidence showing numerous problems emerging from GM crops. Researchers who have published reports on the adverse impacts of GM claim to have been harassed and their reputations attacked. Despite this, there have been more than 400 published scientific papers on the adverse impacts of GM crops/foods. Abstracts of these have been compiled in a book "Adverse Impacts of Transgenic Crops/Foods"[41] which is available from the Coalition for a GM-Free India and Earthcare Books.

> *"Unfortunately, it is impossible to verify that genetically modified crops perform as advertised. That is because agritech companies have given themselves veto power over the work of independent researchers."*
>
> *– Editorial in Scientific American, "Do Seed Companies Control GM Crop Research?" Issue of 13 August, 2009*

Are there better agricultural systems that do not require GM seeds?

Agroecology is increasingly being recognised as the most effective form of agriculture for countries like India with small and marginal farmers. The science of applying ecological concepts in order to develop and manage sustainable agricultural systems is termed agroecology. It relies on enhancing farmers' skills in working with various aspects of the farm environment, rather than purchasing costly external inputs, often by incurring crippling debts. By being able to select from a wide range of traditional seeds, farmers can be more effective in handling climate change than using a limited range of hybrids. It has been found that agroecology, as practiced by many small and innovative farmers, is best able to increase yields and overall farm productivity. It has proved to be a sustainable agricultural system as it improves soil health and reduces water and energy requirements.

According to Olivier de Schutter, United Nations Special Rapporteur on the Right to Food, agro-ecological projects have shown an average crop yield increase of 80% in 57 developing countries, with an average increase of 116% in all African projects.[42]



Photo: CSA

According to an ASSOCHAM Study, organic farming can increase farmers' incomes in West Bengal by 250% in 5 years.



Photo: Priti Joshi

Ten varieties of brinjal on one farm. India has over 2000 brinjal varieties which would have been jeopardized if Bt Brinjal had been approved.

A study by the Associated Chambers of Commerce and Industry of India (ASSOCHAM) titled "Organic West Bengal: Ushering a New Era of Prosperity" found that organic farming can lead to wealth accumulation of Rs 120 billion, generate exports worth Rs 5.5 billion and create nearly 20 lakh employment opportunities during the course of the next five years. It said that organic farms provide over 30% more jobs per hectare as against non-organic farms. Over six lakh additional jobs can also be generated if farm storing, processing, value addition, packaging and marketing facilities are included. The study found that the adoption of organic farming could increase net per capita income of farmers in the state by 250% over a period of five years.[43]

In contrast, chemical-based farming, of which GM is an extension, is unsustainable in the long run and needs ever increasing input costs. It is estimated that in the United States, commercial farming consumes 10 kilocalories of energy to produce one kilocalorie of food.[44]

> *"... the 20th-century industrialization of agriculture has increased the amount of greenhouse gases emitted by the food system by an order of magnitude; chemical fertilizers (made from natural gas), pesticides (made from petroleum), farm machinery, modern food processing and packaging and transportation have together transformed a system that in 1940 produced 2.3 calories of food energy for every calorie of fossil-fuel energy it used into one that now takes 10 calories of fossil-fuel energy to produce a single calorie of modern supermarket food."*
>
> *– Michael Pollan, author and professor of journalism, University of California, Berkeley in article "Farmer in Chief", New York Times Magazine, 9 October, 2008*

In Andhra Pradesh, a state where pesticide use was very high compared to other states, a programme called Community Managed Sustainable Agriculture (CMSA) was started as a small initiative in 2005-06 in order to reduce the burden of input costs and to follow a more sustainable form of agriculture. It began with villagers growing crops without using chemical pesticides (called Non Pesticidal Management or NPM). This has also helped farmers to reduce the use of chemical fertilizers and has stimulated seed production.

Supported by the Andhra Pradesh government and the World Bank, the CMSA movement expanded very rapidly. It now has about 10,000 villages with approximately one million farmers practicing NPM on over 3.5 million acres.[45] During this period the State has registered a reduction in pesticide use by more than 45%. AP is the only state to do so compared to other states with similar cropping patterns and production practices. The net income increase has ranged from Rs. 4,000 to 12,000 per acre per annum, in addition to meeting family food needs of farming households.[46] Many farmers have successfully regained possession of their land from money lenders. In the process, they also supply safe food to consumers and themselves stay free of ailments caused by extensive exposure to agro-chemicals.

A single CMSA village was found to have saved Rs 60 lakhs simply by not using chemical pesticides. The economic and social benefits of enriching the base of the rural pyramid has tremendous implications for rural prosperity. It has far greater socio-economic benefits compared to the revenues generated by a few corporations who profit from sales of proprietary pesticides and patented GM seeds.

In 2008, the World Bank, FAO, WHO and other UN agencies jointly sponsored a global study by over 400 scientists called the International Assessment of Agricultural Science & Technology for Development (IAASTD). Their research found that GM crops do not have a significant role to play in addressing the challenges of climate change, loss of biodiversity, hunger and poverty. Instead, small-scale farmers and agro-ecological methods are the way forward. [47]

This would require drawing on traditional and local knowledge and creating supportive agricultural policies and institutions. Since India is a signatory to the IAASTD Report, why is the government not implementing its recommendations? Why is it instead promoting GM technology whose flaws are increasingly being exposed in independent studies?

> *"Simple solutions for complex problems – as they are being proposed with GMOs as the solutions to production problems of today and climate change impacts of tomorrow – are not credible."*
>
> *– Hans R Herren, Co-chair of the IAASTD (International Assessment on Agricultural Science & Technology for Development) and recipient World Food Prize 1995*

What are the implications of the proposed Biotechnology Regulatory Authority of India (BRAI) Bill?

The above Bill was tabled in Parliament in April 2013. The Bill raises several serious concerns. It proposes to set up a statutory authority, the Biotechnology Regulatory Authority of India, which will serve as a single window clearing house for GM crop approvals. Some of its other features are:

- Concentrating the power of GM approval for the whole country in a five-person committee.
- Over-riding the authority of state governments, although agriculture is a state subject according to the Constitution of India.
- Bypassing the Right to Information Act under the guise of commercial confidentiality.
- Not mandating need assessment or long term, independent, risk assessment.
- Inadequate public participation in decision making on something as vital as food.

- Having no effective deterrent liability mechanism.
- Creating a conflict of interest by placing the BRAI under the Ministry of Science and Technology, whose agenda includes the promotion of GM technology.
- Limiting the issue of GM to a narrow perspective of technology adoption, ignoring the need to prioritise the safety of human health, agricultural systems and environment.

Any bill to regulate GM in agriculture must ensure the following: (1) need assessment, (2) biosafety and (3) the nation's control over seed and food. Regulation should arise only after a need is established based on data and transparent public discussion involving all stakeholders.

Since GM has widespread impacts on all citizens, clearance of any GM crops for field trials or commercialisation should be given after widespread public discussion of benefits and risks. At present, in view of the various negative impacts of GM crops, there is enough reason to apply the Precautionary Principle incorporated in the United Nation's Cartagena Protocol on Biosafety. India is a signatory to this protocol, which states that if any action or policy has a suspected risk of causing harm to the public or the environment and there is an absence of scientific consensus on its impact, the burden of proof that it is not harmful falls on those taking the proposed action.

A law for regulating GM should safeguard biological diversity, protect human health and animal health. At the same time, it should evaluate the socio-economic benefits and risks. Independent testing and research, transparency and public consultation when considering GMO approvals,and a strong deterrent liability system, should be integral to any legislation. Most importantly, the right of states, panchayats and even individuals to stay GM free should be assured.

The report by the Parliamentary Standing Committee on Agriculture[1] was based on two years of deliberations and was unanimous in its recommendations on GM. It recommended that India should enact a biosafety legislation based on the world's best available legislation such as the Norwegian Gene Technology Act (1993). The BRAI Bill has ignored this recommendation. If passed, it will irreversibly compromise the rights of Indian citizens to have safe food and a healthy environment.

Ten former judges of the Supreme Court have stated that the draft BRAI Bill is of serious concern. The Bill has also been opposed by many Parliamentarians, eminent persons and citizens from all walks of life. A general critique of the BRAI bill is available at www.indiagminfo.org[48] and a detailed legal critique by Ritwick Dutta et al is available at www.greenpeace.org.[49]

> *"The contents of the (BRAI) Bill are of serious concern as it may well hasten the introduction of GM crops.... The primary mandate of any Biotechnology Bill must be to ensure safety to consumers, farmers and the environment and not to facilitate quick clearances".*[50]
>
> *A statement signed by 10 former Supreme Court judges*
> *Justices M H Kania, Kuldip Singh,Jeevan Reddy, Manoj Kumar Mukherjee,Sujata Manohar, M.B. Shah, Ruma Pal, Sam Variava, B N Srikrishna and Santosh Hegde*

Conclusion

The benefits of GMOs in agriculture are few and uncertain, particularly for a country like India which predominantly has small farmers, who farm in rainfed conditions and cannot handle the risks of indebtedness arising from costly patented seeds requiring high inputs of fertilizers and water. Agroecology and not GM is the way to prosperity under these conditions, as endorsed by the world's largest study of agricultural knowledge and technology, the IAASTD report.

Fortunately, India has a rich repository of crop varieties and high levels of farmer innovativeness. GM is a technology of last resort when no other options exist. Till now it has failed to fulfill its promises, while increasing risks for farmers, consumers, the environment and the nation's food sovereignty. There is currently no reason to believe that it is in the national interest to introduce GM technology in India.

The Report of the Government of India Task Force on Application of Agricultural Biotechnology, 2004, had stated "Biotech applications which do not involve transgenics, such as bio-pesticides, bio-fertilizers and bio-remediation agents, should be accorded high priority. They will help to enforce productivity in organic farming areas. Transgenic approach should be considered as complimentary and resorted to when other options to achieve the desired objectives are either not available or not feasible".[51]

Adopting this well considered approach to GM and implementing the IAASTD recommendations to promote agroecology is the way forward for Indian agriculture. For this to happen Indian lawmakers need to create a biosafety legislation that truly protects the interests of our nation and our citizens.



India's seeds, foods, environment
Protecting these is in our hands

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Inside front cover

"The essential purpose of food, which is to nourish people, has been subordinated to the economic aims of a handful of multinational corporations that monopolise all aspects of food production, from seeds to major distribution chains, and they have been the prime beneficiaries of the world crisis."

- Miguel d'Escoto Brockmann
- President of the General Assembly of the United Nations,
25 September 2008



Photo: Chandita Mukherjee

Rice, wheat, sorghum (jowar), groundnut, corn, potato, tomato, cabbage, cauliflower, okra, brinjal, mustard, watermelon, papaya and sugarcane are some of the many GM crops presently awaiting approval in India.

Inside back cover

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Dr. G. V. Ramanjaneyulu is an Agriculture Scientist with Centre for Sustainable Agriculture (CSA) working on Sustainable Agriculture and studying the regulatory and economic policies impacting agriculture. CSA works on developing and promoting locally adapted and sustainable farming practices such as organic farming, non-pesticidal management (NPM), open source seeds, ethno-veterinary practices, water conservation and other related matters for ecological and economic sustainability. CSA was instrumental in designing and establishing the Community Managed Sustainable Agriculture model in Andhra Pradesh.

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"The ability to introduce alien genes into a genome is an impressive technological manipulation but we remain too ignorant of how the genome works to anticipate all of the consequences, subtle or obvious, immediate or long-term, of those manipulations "

— David Suzuki
Scientist and Recipient UNESCO Prize for Science

GM FOODS & CROPS
some facts that everyone should know

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Genetic modification in agriculture involves the release of modified living organisms into the open environment. It is a technology which is at present imprecise, potentially hazardous and irreversible. This booklet presents a brief overview of why genetically modified foods and crops are a matter of serious concern to people all over the world.

For more information, readers may refer to the original sources and to:
"GMO Myths and Truths" by Michael Antoniou, Claire Robinson and John Fagan.
"Adverse Impacts of Transgenic Crops/Foods": A Compilation of Scientific References with Abstracts" by Kavitha Kuruganti et al. It contains abstracts of 400 peer reviewed scientific papers.

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